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# Are Reading and Behavior Problems Risk Factors for Each Other?

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Two questions were investigated. First, are children with reading problems in first grade more likely to experience behavior problems in third grade? Second, are children with behavior problems in first grade more likely to experience reading problems in third grade? The authors explored both questions by using multilevel logistic regression modeling to analyze data from the *Early Childhood Longitudinal Study–Kindergarten Class* (ECLS-K). After statistically controlling for a wide range of potential confounds, they found that children with reading problems in first grade were significantly more likely to display poor task engagement, poor self-control, externalizing behavior problems, and internalizing behavior problems in third grade. They also found that children displaying poor task engagement in first grade were more likely to experience reading problems in third grade. Collectively, these findings suggest that the most effective types of interventions are likely to be those that target problems with reading and task-focused behaviors simultaneously.

***Keywords:*** *reading problems; reading disabilities; behavior problems; emotional and behavioral disorders; at-risk students*

Academic underachievement and problem behaviors frequently co-occur (e.g., Hinshaw, 1992; Reid, Gonzalez, Nordness, Trout, & Epstein, 2004; Rutter & Yule, 1970; Trout, Nordness, Pierce, & Epstein, 2003). The link with reading difficulties is particularly well established (e.g., Arnold et al., 2005; Kauffman, Cullinan, & Epstein, 1987; McGee, Williams, Share, Anderson, & Silva, 1986). For example, Greenbaum et al. (1996) found that the percentage of children with emotional and behavioral disorders (EBD) reading below grade level increased from 54% to 85% across the study's 7-year span. Nelson, Benner, Lane, and Smith (2004) reported that 83% of their study's sample of children with EBD scored below the norm group on a standardized measure of reading skill.

One of four causal models explains this co-occurrence (for reviews, see Hinshaw, 1992; Spira & Fischel, 2005). First, it may be that "common cause" variables (e.g., poor attention) lead to problems in both reading and behavior. This model implies that the relation between reading and behavior problems is spurious. Second, it may be that reading problems result in behavior problems. Reading difficulties might trigger frustration, agitation, acting out, avoidance, and withdrawal from learning tasks (e.g., Fleming, Harachi, Cortes, Abbott, & Catalano, 2004; Kellam, Mayer, Rebok, & Hawkins, 1998; Lane, Beebe-Frankenberger, Lambros, & Pierson, 2001; Walker, Colvin, & Ramsey, 1995; Wehby, Falk, Barton-Arwood, Lane, & Cooley, 2003). If so, then instruction that improves a child's reading skills should help decrease his or her problem behaviors. This should occur because the behaviors were being maintained by a desire to escape an aversive task.

Third, it may be that behavior problems lead to reading problems. Off-task and disruptive behaviors might decrease attending to instruction and activities, thereby worsening a child's school performance (Coie, 1996; Ialongo et al., 1999; Kellam et al., 1991; Lane, 1999; Rabiner, Coie, & the Conduct Problems Prevention Research Group, 2000; Reid, 1993; Reid, Eddy, Fetrow,

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& Stoolmiller, 1999; Walker et al., 1995). Consequently, reducing those behaviors that are interfering with the child's learning should help improve his or her reading ability.

Fourth, it may be that reading and behavior problems cause each other. Both factors might be reciprocally causative over time, leading to a negative feedback cycle of increasing problem behaviors, school disengagement, and academic failure (McGee et al., 1986). Such a cycle would complicate intervention efforts. Depending on the timing of the cycle's feedback effects, effectively remediating poor reading ability may require interventions that target both reading and behavioral deficits.

## Theoretical Explanations of the Bidirectional Model

Why might reading and behavior problems cause each other? One possibility is that the negative feedback cycle is set in motion by a child's early reading failure. For example, Stanovich (1986) hypothesizes that early reading failure, which itself results from cognitive deficits in phonological processing, should initiate a "causal chain of escalating negative side effects" (p. 364). Specifically, "the combination of lack of practice, deficient decoding skills, and difficult materials results in unrewarding early reading experiences that lead to less involvement in reading-related activities" (p. 364). The reading disabled child's increasing feelings of frustration and anxiety, learned helplessness, or difficulties in self-regulating emotions should, in turn, maintain his or her reading failure (e.g., Aunola, Leskinen, Onatsu-Arvilommi, & Nurmi, 2002; Chapman, Tunmer, & Prochnow, 2000). This occurs because the child begins to avoid both reading activities in the classroom and reading practice in the home (Stanovich, 1986). This avoidance of reading tasks should constrain further growth in the child's basic reading skills, comprehension strategies, and later, cognitive capacities (Cunningham & Stanovich, 1991; Echols, West, Stanovich, & Zehr, 1996; Griffiths & Snowling, 2002; Guthrie, Schafer, & Huang, 2001; Senechal, LeFevre, Hudson, & Lawson, 1996). Prolonged reading failure should lead to increasingly more generalized deficits in cognition, motivation, and behavior. Early reading failure should, therefore, contribute to a range of later behavior problems.

Another possibility is that the cycle is initiated by the young child's lack of higher order skills in planning, initiation, and self-regulation of goal-directed behavior. The lack of such skills may itself be the result of deficits in executive functioning (Stevens, Kaplan, & Hesselbrock, 2003). Executive functions are "general-purpose control mechanics that modulate the operation of various cognitive subprocesses and thereby regulate the dynamics of human cognition" (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000, p. 50). These self-regulatory processes include "planning, organizational skills, selective attention, and inhibitory control" (Morgan & Lilienfeld, 2000, p. 114). The disabled child's limited ability to self-regulate his or her behavior should limit his or her capacity to manage the classroom's learning environment. Because of the child's resulting frustration and anxiety (Elliott & Mirsky, 2002), these behaviors should contribute to heightened aggression or withdrawal (Giancola, Mezzich, & Tarter, 1998; Riggs, Greenberg, Kusche, & Pentz, 2006). The child's skills growth in reading should be uneven, at best, because time spent engaging in this second set of problem behaviors should further interfere with his or her task engagement (Johnson, McGue, & Iacono, 2005). Consequently, behavior problems related to planning, organization, and task persistence, as well as subsequent behaviors like acting out and withdrawal, should contribute to later reading problems.

Which of the four causal models explains the co-occurrence between reading and behavior problems? The answer to this question is important in order to better understand the etiology of learning disabilities (LD). Most children with LD are poor readers (e.g., Snow, Burns, & Griffin, 1998). Many children with LD also display task avoidant behaviors (e.g., Beitchman & Young, 1997; Fulk, Brigham, & Lohman, 1998). Indeed, the potential interaction between poor reading ability and such behaviors is viewed as a primary reason that children with LD often underachieve academically (e.g., McDermott, Goldberg, Watkins, Stanley, & Glutting, 2006; Stanovich, 1986; Torgesen, 1982; Torgesen et al., 1999).

The answer to this question also has important practical implications. Schools face a difficult choice when deciding which type of deficit to remediate. Significant deficits in either reading (e.g., Adams, 1990; Snow et al., 1998) or behavior (e.g., Schaeffer, Petras, Ialongo, Poduska, & Kellam, 2003; Sprague & Walker, 2000) place children at great risk for negative long-term outcomes (e.g., delinquency, dropout, poverty, unemployment, incarceration). Deficits in either reading (e.g., Torgesen et al., 2001; Torgesen et al., 1999) or behavior (e.g., Kazdin, 1987; Walker et al., 1995) also quickly become resistant to intervention. Thus, schools have a narrow window of opportunity to effectively provide either type of intervention. Yet, schools typically have only limited resources available to deliver special services. Which deficit, then, should they target? If, for

example, reading problems cause behavior problems, then school staff could devote more of their scarce resources toward reading skills interventions and still expect to see improvements in children's behaviors. In contrast, if reading and behavior problems cause each other, then interventions targeting only reading problems, without simultaneously attending to a child's behavior problems, may ultimately prove ineffective.

## Methodological Approaches to Evaluating the Causal Nature of the Co-Occurrence

To date, two different types of methodologies have been used to determine the causal nature of co-occurring reading and behavior problems. First, some researchers have used experimental or quasi-experimental designs. Most of these researchers have attempted to remediate children's reading deficits to determine whether there is a corresponding decrease in the occurrence of problem behavior. Results from these intervention studies are mixed (Rivera, Al-Otaiba, & Koorland, 2006). Whereas some researchers report declines in problem behavior after improving a child's reading skill (e.g., Allyon & Roberts, 1974; Coie & Krehbiel, 1984; Kellam et al., 1998), others do not (e.g., Barton-Arwood, Wehby, & Falk, 2005; Lane, 1999; Nelson, Stage, Epstein, & Pierce, 2005; Wehby et al., 2003). The intervention studies are rare (Levy & Chard, 2001). Coleman and Vaughn (2000) identified only three published reading intervention studies using samples of young children with EBD. Rivera et al.'s (2006) more recent review identified only six such studies. Few studies have attempted to boost children's reading skills by improving their social skills (Allyon & Roberts, 1974; Kellam et al., 1998; Wooster, 1986; Wooster & Carson, 1982). The intervention studies are also methodologically limited (Lane, 2004). The limited and mixed experimental and quasi-experimental literature makes any causal inferences tenuous (Hinshaw, 1992).

A second group of studies has used "causal modeling" statistical techniques. These studies have sought to statistically control for confounding variables (e.g., socioeconomic status [SES]) while testing one of the aforementioned models (for methodological discussions, see Aneshensel, 2002; Kenny, 1979; Shadish, Cook, & Campbell, 2002). If the tested model is indeed "true" (i.e., accurately specified and estimated without undue measurement error), then findings from a modeling study can help provide an estimate of *fit*, or the strength of the interrelations between a set of hypothesized causal factors (Shadish et al., 2002). When the outcome is a disease, disorder, or condition, as is the case here, modeling studies provide an estimate of *risk*, or the likelihood of experiencing the outcome (e.g., being diagnosed with cancer) given another condition (e.g., being a smoker). If a relation remains between one condition and another after accounting for multiple confounding factors, then the relation is more likely to be causal (see Thun, Apicella, & Henley, 2000, for an epidemiological example).

Unlike the intervention studies, the modeling studies have appeared fairly frequently. For instance, Hinshaw (1992) summarized findings from 17 such studies. Collectively, this literature suggests a bidirectional causal model between reading and behavior problems. In some studies, reading problems lead to behavior problems (e.g., Bennett, Brown, Boyle, Racine, & Offord, 2003; Carroll, Maughan, Goodman, & Meltzer, 2005). In other studies, behavior problems lead to reading problems (e.g., Jorm, Share, Matthews, & Maclean, 1986; Spira, Bracken, & Fischel, 2005). Studies directly testing for an early interplay between reading and behavior also find support for a bidirectional model (e.g., Lepola, Poskiparta, Laakkonen, & Niemi, 2005; Onatsu-Arvilommi & Nurmi, 2000).

## Methodological and Substantive Limitations of the Modeling Literature

However, methodological limitations have been noted in much of the modeling literature. Hinshaw (1992) points out that many of these studies fail to control for either earlier reading or behavior problems as a predictor. Some of the modeling studies do not include likely common cause variables in the analyses (Fleming et al., 2004). This is problematic because at least one such variable (i.e., poor attention) has already been identified as accounting for most of the association between academic underachievement and behavior problems (Maguin & Loeber, 1996). Factors such as gender, race/ethnicity, and social class also act as consistent predictors of differences in reading and behavior (e.g., Feil et al., 2005; Kaplan & Walpole, 2005; Landgren, Kjellman, & Gillberg, 2003; Lepola, 2004; Riordan, 2002; Sanchez, Bledsoe, Sumabat, & Ye, 2004) and, thus, should be statistically controlled as confounds. Relatively few studies are longitudinal. Collectively, the modeling studies' aforementioned limitations "severely constrain inferences regarding causal precedence" (Hinshaw, 1992, p. 146).

There is also an important substantive limitation of the extant literature. Investigations of the relation between reading and behavior problems focus primarily on *externalizing* (e.g., being disruptive, oppositional-defiant, or aggressive) problem behavior (Fleming et al., 2004;

Hinshaw, 1992). Yet, such behavior problems are just one type of problem behavior that teachers confront. For example, teachers work with students who are frequently (a) task avoidant or socially dependent (i.e., exhibiting poor task engagement), (b) socially avoidant, depressed, phobic, or anxious (i.e., exhibiting internalizing problem behaviors), or (c) argumentative or inappropriate with their peers (i.e., exhibiting poor self-control or interpersonal skills). By concentrating on whether reading problems cause or are caused by externalizing problem behaviors, researchers may have inadvertently ignored whether reading problems also affect or are affected by other types of problem behaviors.

## Purposes of This Study

This study had two purposes. First, we tested whether, after controlling for earlier problem behaviors and other antecedent variables, children's reading problems predict their later behavior problems. Here, we investigated a set of interrelated questions. Does being a poor reader in first grade increase the odds that a child will display problem behavior in third grade? Does this relation hold after controlling for whether the children were already displaying these problem behaviors in first grade? Does this relation continue to hold after controlling for a large number of antecedent variables, including poor attention, family- and school-level poverty, gender, and race? We tested for this relation by examining how reading difficulties affect each of five types of problem behaviors: poor task engagement, poor self-control, poor interpersonal skills, internalizing problem behaviors, and externalizing problem behaviors.

Second, we investigated whether, after controlling for both prior reading problems and a range of antecedent variables, early manifestations of problem behavior predict later relative reading failure. Again, we asked a set of interrelated questions. Does displaying any of the five types of problem behaviors increase the odds that a child will be a poor reader in third grade? Does this relation hold after controlling for whether the child was already a poor reader in first grade? Does this relation continue to hold after controlling for a large number of potential confounds?

We sought to determine the strength of the interrelations between reading and behavior problems. Thus, we investigated the aforementioned questions using multilevel logistic regression modeling. This analytical approach, which quantifies whether and to what degree one condition acts as a risk factor for another condition, is commonly used in epidemiological studies of diseases and disorders (e.g., Buzi et al., 2003; Feil et al., 2005; Gould, Herrchen, Pham, Bera, & Brindis, 1998; Marshall et al., 1999). Here, we dichotomized children as having or not having reading or behavior problems. Analyses based on dichotomization are sometimes criticized as coarse (e.g., Kachigan, 1991). However, in this study, we were not seeking to estimate the strength of the relationship between reading and behavior per se. This is because it is *problems* in reading or behavior—whether defined as performing worse than 90% of one's peers or by some other criterion—that are hypothesized to act as risk factors for the aforementioned negative outcomes (e.g., Stanovich, 1986). When the goal is information that can be used to more effectively target experimental and quasi-experimental intervention work, as is the case here, it is important to focus analyses on the interplay between known risk factors, especially those that may be amenable to treatment (e.g., Bennett et al., 2003; Catts, Fey, Zhang, & Tomblin, 2001; Maxwell, Bastani, & Warda, 2000; Nash & Bowen, 2002).

Our analyses estimate the strength of relations between reading and behavior problems in a hypothesized bidirectional causal model. The methodological richness of the study's database (e.g., large sample size, multiple time points, measures of many different possible confounds, individually administered reading achievement tests, measures of different categories of problem behavior) is the type called for when testing such a model (Hinshaw, 1992). The nature of our statistical analyses meets the conditions necessary for making preliminary (but not conclusive) inferences about causality (Cohen, Cohen, West, & Aiken, 2003; Hinshaw, 1992; Kenny, 1979; Shadish et al., 2002). Collectively, the size and quality of the database, combined with the wide range of covariates accounted for in our statistical analyses, should provide researchers, policy makers, and practitioners with a relatively accurate estimate of the nature and strength of the hypothesized model's interrelations and, in so doing, help guide subsequent experimental and quasi-experimental intervention efforts that can then be used to confirm causal inferences (e.g., Cohen et al., 2003; Hinshaw, 1992; National Center for Education Statistics, 2004).

## Method

### Study's Database

The study's data set was the *Early Childhood Longitudinal Study–Kindergarten Class* (ECLS-K). The ECLS-K is maintained by the U.S. Department of Education's National Center for Education Statistics (NCES). The ECLS-K is the first large-scale nationally

representative sample of children as they age through the elementary school years. The sample was selected to be representative of all students in kindergarten in fall 1998. Children were recruited from both public and private kindergartens offering full- or half-day classes. The sample was constructed to support separate analyses of kindergarteners in public and private schools, as well as Black, Hispanic, White, and Asian children and those of varied SES. The NCES used sample freshening to help make the ECLS-K representative of all first graders in fall 1999. Data from the sampled children were collected at the beginning and end of kindergarten, in the fall and spring of first grade (with a random subsample in the fall), and again in the spring of third grade. Data continue to be collected as the children advance further through the grade levels.

## Study's Analytical Sample

Table 1 displays descriptive statistics for the study's analytical sample. This sample included 11,515 students attending 1,471 public and private elementary schools. The sample was 50% male. Age averaged 65.6 months when data were first collected in fall of kindergarten. The remaining variables in Table 1 are the key independent and dependent variables for the study's multilevel logistic regression modeling analyses. Table 2 displays descriptive statistics using scale scores for the groups of children classified as at risk for reading or behavioral disabilities in the spring of first or third grade.

## Measures

*The Reading Test*. The questions on the *Reading Test* seek to assess basic skills (e.g., print familiarity, letter recognition, beginning and ending sounds, rhyming words, phonemic awareness, decoding, sight word recognition), vocabulary (receptive vocabulary), and comprehension (i.e., demonstrating an understanding of the text, making interpretations, using personal background knowledge, and taking a critical stance). The measure was administered individually. Most of the *Reading Test*'s items used a multiple-choice format; a small number were open-ended questions or called for a constructed response. The *Reading Test*'s content emphasis changes over time to reflect children's growth as readers. For first graders, 40%, 10%, and 50% of the measure's testing time is devoted to assessing basic skills, vocabulary, and comprehension, respectively. For third graders, these percentages change to 15%, 10%, and 75%, respectively.

The *Reading Test* was created through a multistage panel review. Some items were borrowed or adapted from published tests (e.g., the *Peabody Picture Vocabulary Test–Revised*, the *Woodcock Johnson Tests of Achievement–Revised*). The Educational Testing Service, elementary school curriculum specialists, and practicing teachers supplied other items. All items were field tested. Items were included in the *Reading Test*'s final form if they displayed (a) acceptable item-level statistics, (b) good fit with maximum likelihood item response theory (IRT) parameters, and (c) no differential item functioning across gender or race (NCES, 2004). The ECLS-K uses a routing procedure (i.e., a child is given a different battery of test items depending on the accuracy of his or her initial responses) and IRT methods to derive scale scores that are comparable across grade levels. The NCES considers reliabilities of the *Reading Test*'s IRT theta scores (i.e., estimates of a child's ability) to be the most appropriate internal consistency estimate. These reliabilities were .96 and .94 for the end of first and third grade, respectively (NCES, 2004). First graders' *Reading Test* scores correlated .85 or above with the *Kaufman Test of Educational Achievement* reading test (NCES, 2002); third graders' scores correlated .83 with the *Woodcock-McGrew-Werder Mini-Battery of Achievement* (NCES, 2005a).

*Teacher Social Rating Scale*. The ECLS-K uses an adapted version of the *Social Skills Rating System* (SSRS; Gresham & Elliott, 1990) to measure children's behavior. The original psychometric data of the SSRS were based on 4,170 K-12 students (Gresham & Elliott, 1990). Of these, 83% and 17% attended general education and special education classes, respectively. The test–retest correlation over 4 weeks was .85 for the teacher ratings (Gresham & Elliott, 1990). Both correlational and factor analyses support the measures' construct validity (Feng & Cartledge, 1996; Furlong & Karno, 1995).

The NCES adapted the SSRS for use with the ECLS-K sample. These changes included (a) the addition of items measuring the child's frequency of positive affect, behavior, and approaches to learning, (b) expanding the response format from a 3-point to a 4-point scale and including a "not observed" response, and (c) rewording some items to reduce cultural bias (e.g., changing "Responds appropriately when pushed or hit by other children" to "Firmly tells an aggressive peer to stop hurtful acts," e.g., "Stop hitting," "No pushing"). Meisels, Atkins-Burnett, and Nicholson (1996) provide additional details of the adaptations to the SSRS.

The ECLS-K's *Teacher Social Rating Scale* includes five subscales: (a) Approaches to Learning, (b) Self-Control, (c) Interpersonal Skills, (d) Externalizing

**Table 1**
**Descriptive Statistics of the Study's Analytical Sample**

| Variable | *M* | *SD* | Min | Max |
|---|---|---|---|---|
| Gender—male (T1) | 0.50 | 0.50 | 0.00 | 1.00 |
| Age at K entry in months (T1) | 65.59 | 4.27 | 51.90 | 80.32 |
| Mother's educational level (T4) | | | | |
| Less than high school | 0.12 | 0.32 | 0.00 | 1.00 |
| High school diploma or equivalent | 0.29 | 0.45 | 0.00 | 1.00 |
| Some college (including vocational/technical training) | 0.34 | 0.47 | 0.00 | 1.00 |
| Bachelor's degree or higher | 0.25 | 0.43 | 0.00 | 1.00 |
| Father's educational level (T4) | | | | |
| Less than high school | 0.13 | 0.34 | 0.00 | 1.00 |
| High school diploma or equivalent | 0.32 | 0.47 | 0.00 | 1.00 |
| Some college (including vocational/technical training) | 0.29 | 0.45 | 0.00 | 1.00 |
| Bachelor's degree or higher | 0.26 | 0.44 | 0.00 | 1.00 |
| Family living below federal poverty level (T4) | 0.17 | 0.38 | 0.00 | 1.00 |
| Family received AFDC (T4) | 0.04 | 0.21 | 0.00 | 1.00 |
| Family received food stamps (past 12 months) (T4) | 0.12 | 0.32 | 0.00 | 1.00 |
| Received WIC (T1) | | | | |
| During both pregnancy and childhood | 0.35 | 0.48 | 0.00 | 1.00 |
| During either pregnancy or childhood | 0.07 | 0.25 | 0.00 | 1.00 |
| During neither pregnancy nor childhood | 0.58 | 0.49 | 0.00 | 1.00 |
| Head Start participation (T1) | 0.15 | 0.35 | 0.00 | 1.00 |
| Race (T1) | | | | |
| Black non-Hispanic | 0.12 | 0.32 | 0.00 | 1.00 |
| Hispanic | 0.17 | 0.38 | 0.00 | 1.00 |
| Asian | 0.07 | 0.25 | 0.00 | 1.00 |
| Other | 0.05 | 0.23 | 0.00 | 1.00 |
| White non-Hispanic | 0.59 | 0.49 | 0.00 | 1.00 |
| Household structure (T4) | | | | |
| Single-parent family | 0.18 | 0.39 | 0.00 | 1.00 |
| Other structures | 0.12 | 0.32 | 0.00 | 1.00 |
| Two parents, both biological | 0.70 | 0.46 | 0.00 | 1.00 |
| Number of siblings in household (T4) | 1.54 | 1.19 | 0.00 | 10.40 |
| Primary home language—not English (T4) | 0.14 | 0.35 | 0.00 | 1.00 |
| Current mom teenager at first birth—younger than 19 (T1) | 0.21 | 0.41 | 0.00 | 1.00 |
| Census region (T4) | | | | |
| Northeast | 0.19 | 0.39 | 0.00 | 1.00 |
| Midwest | 0.26 | 0.44 | 0.00 | 1.00 |
| South | 0.32 | 0.47 | 0.00 | 1.00 |
| West | 0.23 | 0.42 | 0.00 | 1.00 |
| Urbanicity (T4) | | | | |
| Large and mid-size cities | 0.38 | 0.48 | 0.00 | 1.00 |
| Large and mid-size suburb and large town | 0.39 | 0.49 | 0.00 | 1.00 |
| Small town and rural | 0.23 | 0.42 | 0.00 | 1.00 |
| More than 25% Black students in school—Level 2 (T4) | 0.17 | 0.35 | 0.00 | 1.00 |
| More than 25% Hispanic students in school—Level 2 (T4) | 0.15 | 0.33 | 0.00 | 1.00 |
| % eligible for free lunch—Level 2 (T4) | 31.18 | 22.46 | 0.00 | 95.00 |
| Reading in bottom 10% (IRT scale) (T4) | 0.09 | 0.28 | 0.00 | 1.00 |
| Reading in bottom 10% (IRT scale) (T5) | 0.09 | 0.29 | 0.00 | 1.00 |
| Approaches to learning—bottom 10% (T4) | 0.10 | 0.30 | 0.00 | 1.00 |
| Approaches to learning—bottom 10% (T5) | 0.09 | 0.29 | 0.00 | 1.00 |
| Self-control—bottom 10% (T4) | 0.08 | 0.26 | 0.00 | 1.00 |
| Self-control—bottom 10% (T5) | 0.11 | 0.31 | 0.00 | 1.00 |
| Interpersonal skills—bottom 10% (T4) | 0.07 | 0.26 | 0.00 | 1.00 |
| Interpersonal skills—bottom 10% (T5) | 0.08 | 0.27 | 0.00 | 1.00 |
| Externalizing behavior problems—upper 10% (T4) | 0.09 | 0.29 | 0.00 | 1.00 |
| Externalizing behavior problems—upper 10% (T5) | 0.09 | 0.28 | 0.00 | 1.00 |
| Internalizing behavior problems—upper 10% (T4) | 0.08 | 0.26 | 0.00 | 1.00 |
| Internalizing behavior problems—upper 10% (T5) | 0.09 | 0.29 | 0.00 | 1.00 |

Note: Level 1 $n$ = 11,515. Level 2 $n$ = 1,471. T1 = fall of kindergarten; T4 = spring of first grade; T5 = spring of third grade; AFDC = Aid to Families with Dependent Children; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children; IRT = item response theory.

**Table 2**
**Descriptive Statistics of the Groups of Children Classified as At Risk or Not At Risk for Reading or Behavioral Disabilities**

| | Bottom 10% (T4) | | | Upper 90% (T4) | | | Bottom 10% (T5) | | | Upper 90% (T5) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | *M* | Min | Max | *M* | Min | Max | *M* | Min | Max | *M* |
| Reading score | 16.54 | 41.61 | 34.74 | 41.62 | 141.36 | 71.60 | 42.36 | 79.38 | 67.57 | 79.39 | 148.95 | 111.87 |
| Approaches to learning | 1.00 | 2.00 | 1.78 | 2.00 | 4.00 | 3.19 | 1.00 | 2.12 | 1.82 | 2.12 | 4.00 | 3.15 |
| Self-control | 1.00 | 2.25 | 1.94 | 2.25 | 4.00 | 3.28 | 1.00 | 2.25 | 2.04 | 2.25 | 4.00 | 3.31 |
| Interpersonal skills | 1.00 | 2.20 | 1.88 | 2.20 | 4.00 | 3.20 | 1.00 | 2.20 | 1.87 | 2.20 | 4.00 | 3.17 |
| | Bottom 90% (T4) | | | Upper 10% (T4) | | | Bottom 90% (T5) | | | Upper 10% (T5) | | |
| | Min | Max | *M* | Min | Max | *M* | Min | Max | *M* | Min | Max | *M* |
| Externalizing problems | 1.00 | 2.60 | 1.51 | 2.60 | 4.00 | 3.02 | 1.00 | 2.50 | 1.59 | 2.50 | 4.00 | 3.01 |
| Internalizing problems | 1.00 | 2.25 | 1.50 | 2.25 | 4.00 | 2.75 | 1.00 | 2.26 | 1.53 | 2.26 | 4.00 | 2.74 |

Note: T1 = fall of kindergarten; T4 = spring of first grade; T5 = spring of third grade.

Problem Behaviors, and (e) Internalizing Problem Behaviors (NCES, 2004). Teachers use a frequency scale to rate how often the child displays a particular social skill or behavior (i.e., 1 = *never* to 4 = *very often*). The NCES included two additional items on the third-grade version of the scale (i.e., one additional item on the Approaches to Learning scale, and one additional item on the Externalizing Problem Behaviors scale). The Approaches to Learning scale's six to seven items measure behaviors that affect how well a child benefits from the classroom environment (e.g., displays attentiveness, task persistence, eagerness to learn, learning independence, easily adapts to changes in routine, and organization). The Self-Control scale's four items rate a child's ability to control his or her behavior (i.e., respecting the property rights of others, controlling his or her temper, accepting a peer's ideas for group activities, responding appropriately to peer pressure). The Interpersonal Skills scale includes five items that measure the child's ability to initiate and maintain friendships (i.e., get along with people who are different; comfort or help peers; express his or her feelings, ideas, and opinions appropriately; and show sensitivity to the feelings of others). The five to six items of the Externalizing Problem Behaviors scale measure acting out behaviors (e.g., arguing, fighting, showing anger, acting impulsively, disturbing the classroom's ongoing activities). The four items on the Internalizing Problem Behavior scale ask whether the child appears anxious, lonely, or sad or has low self-esteem.

The NCES (2005a) reports that the split-half reliabilities for the five scales for first-grade and third-grade children were, respectively, .89 and .91 (Approaches to Learning), .80 and .79 (Self-Control), .89 and .89 (Interpersonal Skills), .86 and .89 (Externalizing Problem Behaviors), and .77 and .76 (Internalizing Problem Behaviors). Exploratory and confirmatory factor analyses confirmed the full scale's structure (NCES, 2005a). Correlations among the Approaches to Learning, Self-Control, Interpersonal Skills, and Externalizing Problem Behaviors scales ranged from .59 to .81 for third graders. Correlations with the Internalizing Problem Behaviors scale and the other scales ranged between .32 and .41.

*Controlled confounds*. We included many antecedent variables that might act as potential confounds of the relationship. These belonged to one of two blocks of confounds. The first was a block of variables indexing family resources (i.e., mother's and father's education level; whether the family's income was below the federal poverty level; whether the family participated in federal assistance programs, such as Aid to Families with Dependent Children or Head Start; the percentage of the school's students eligible for free lunch). The second was a block of variables indexing demographic differences (i.e., the child's race and ethnicity, the child's gender, whether the language spoken at home was English, whether the racial composition of the child's school was more than 25% Black or Hispanic, the child's household structure and number of siblings, the mother's age at first birth, the child's age at kindergarten entry, whether the child's school was located in an urban or rural location). In addition, we included both the "autoregressor" (e.g., whether the child was already displaying either poor reading ability or abnormal levels of the specific behavior type in first grade) and a control for task-focused attention (i.e., scoring in the bottom 10% of the Approaches to Learning or, when predicting Approaches, the bottom 10% of the Self-Control scale in first grade). The former is a strong confound (e.g., Badian, 2001; Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997); the latter is considered a common cause variable to the relation (Fleming et al., 2004; Hinshaw, 1992).

## Data Collection Procedures

Children completed the *Reading Test* during one-to-one, untimed sessions with a trained assessor. The ECLS-K assessor was trained to administer the *Reading Test* through a multistage process including 5 days of interactive lectures, scripted role-plays, interactive exercises, and self-administered exercises (see NCES, 2005b, for additional training details). To be certified to administer the *Reading Test*, the adult assessor had to be able to (a) accurately score responses on the test (e.g., read questions verbatim) and (b) display appropriate test-administrating behaviors (e.g., build rapport, use neutral praise, avoid coaching) while working with an actual child respondent. The NCES reports that 98.2% of the third-grade assessors scored an 85% or above on its *Reading Test* certification test. The 1.8% of assessors scoring below 85% completed remedial training.

Teachers completed the self-administered *Teacher Social Rating Scale* each time children were assessed. Teachers were mailed a copy of the scale, which included a cover sheet and a summary of the study and its goals. Teachers were monetarily compensated for their time. ECLS-K field staff called and visited teachers to assist them and to prompt return of the completed assessments (NCES, 2005b).

## Analytical Strategy

Because our theoretical focus was on whether students fall into the "problem" group in reading or behavior, we

dichotomized these variables at the 10% cutoff at the "worst" end of their distribution in first and third grades (i.e., bottom 10% on the *Reading Test*, Approaches to Learning, Self-Control, and Interpersonal Skills scales, or the top 10% on the Internalizing Behavior Problems or Externalizing Behavior Problems scales for the full sample) as displaying abnormal levels of that specific behavior. Those children with scores in the remaining 90% of the full sample for each scale were considered not to be displaying abnormally poor levels of that skill or behavior. The 10% cutoff was applied separately for all interviewed first graders and all interviewed third graders. We based this 10% cutoff on previous empirical work on the prevalence of clinically significant reading (Catts et al., 2001; Konold, Juel, & McKinnon, 1999) and behavior (Feil et al., 2005; Roberts, Attkisson, & Rosenblatt, 1998) problems.

We used multilevel logistic regression modeling to determine whether reading and behavior problems acted as risk factors for each other. Logistic regression is a frequently used analytical tool to identify risk factors for diseases, disorders, or conditions (Ely, Dawson, Mehr, & Burns, 1996) such as severe reading or behavioral difficulties (e.g., Bennett et al., 2003; Carroll et al., 2005; Catts et al., 2001). Logistic regression produces odds ratios as an estimate of effect size. An odds ratio is the odds [i.e., (the probability of an event)/(1 – the probability of an event)] of experiencing an event for Group A relative to that of Group B (Case, Kimmick, Paskett, Lohman, & Tucker, 2002). We used Hierarchical Linear Modeling (HLM) to perform regressions that statistically adjusted for the spatially clustered nature of the sample design (i.e., students within schools) and the wide variety of potentially confounding variables (Raudenbush & Bryk, 2002).

## Missing Data

Missing data are common in longitudinal data sets. This is particularly likely to occur in data sets that attempt to administer a wide range of measures across several years to a large and varied (e.g., children, parents, teachers, administrators) sample. Here, missing data accounted for between 0% and 23% of the child-level predictors and between 23% and 38% of the school-level predictors. Analysts of longitudinal data sets sometimes restrict their attention to sample members for whom complete data are available (e.g., Buhs, Ladd, & Herald, 2006; Kaplan & Walpole, 2005). In contrast, we responded to the ECLS-K's amount of missing data by using multiple imputation procedures (Allison, 2002; R. Little & Rubin, 1987; Rubin, 1987; Schafer, 1997). Use of multiple imputation results in parameter estimates and standard errors that take into account uncertainty due to missing data (Sinharay, Stern, & Russell, 2001). Recent examples of the utility of this method in the behavioral and health sciences include Taylor et al. (2002), Barzi and Woodward (2004), and Moskowitz, Laraque, Doucette, and Shelov (2005).

We used the IVEware software (Raghunathan, Solenberger, & Van Hoewyk, 2002) to impute missing values, resulting in five imputed data sets. The software uses a sequence of multiple regressions to compute predicted values for each individual and then, for each predicted value, adds an error term, which is selected as a random draw from the residual distribution for that variable. The type of regression model used varies according to the type of variable that is imputed. The procedure uses a normal regression model to impute missing values for both ordinal (e.g., urbanicity) and continuous (e.g., age at kindergarten entry, mother's age at first birth, percentage eligible for free lunch) variables, a logistic or generalized logistic model for missing categorical variables (e.g., living below the poverty level, primary home language, census region), and a Poisson regression model to estimate missing count variable (e.g., number of siblings; see Raghunathan et al., 2002).

The sequential regression multivariate imputation (SRMI) method is based on the assumptions that the sample is a simple random sample and the missing data mechanisms are ignorable (Raghunathan et al., 2002). The SRMI method does not account for the nesting of students within schools. Therefore, we imputed both individual-level and school-level variables at the individual level and then used school means to construct the school-level variables. We also assumed that the data were missing at random (MAR; Allison, 2002). Specifically, we considered it a plausible assumption that, given the presence of all the included control and auxiliary variables, the probability of missing data on a variable was unrelated to the value of that variable. Collins, Schafer, and Kam (2001) recommend the inclusion of auxiliary variables that might be correlates of missingness in the imputation process to achieve a situation closer to MAR. At the same time, their simulations suggest that, in the typical case, an erroneous assumption of MAR will have little effect on estimates and standard errors in the substantive model.

We used an imputation model that included all of the variables present in the HLM analyses and several other auxiliary variables (reading and behavior scores during fall and spring of kindergarten) that were correlated with variables in the substantive model. The inclusion of auxiliary variables in the imputation model is designed to provide controls for additional missing data mechanisms

(Acock, 2005; Collins et al., 2001) to improve prediction of missing values in each variable, in particular in our endogenous variables, and has been shown to improve the reliability and efficiency of estimates (Allison, 2002; Raghunathan et al., 2002). We chose to include our endogenous variables in the imputation model because this produces unbiased estimates of regression coefficients. We also used the imputed endogenous variables in the substantive analyses because cases with missing data on endogenous variables also have missing data on some of the independent variables (Allison, 2002).

The hierarchical linear model assumes that students are nested within the same schools at each of the two time points. Thus, we restricted attention to students who did not change schools between these survey rounds (see Note 1). The multiple imputation technique will produce unbiased coefficient estimates on this sample as long as, conditional on control variables in the regressions, data are MAR. Our data likely approximate this situation because we have used an unusually extensive and detailed set of control variables and allowed a number of them (e.g., mother's and father's education) to have nonlinear effects by entering them as dummy variables for multiple categories. We used the HLM software to (a) conduct a separate HLM analysis for each of the five complete (with imputed values) data sets, (b) average parameter estimates across the five resulting complete data sets, and (c) compute the standard errors of these estimates (Raudenbush, Bryk, Cheong, & Congdon, 2004).

## Results

### Are Reading Problems a Risk Factor for Behavior Problems?

The first independent variable of interest for this study's regressions was the dummy variable for reading problems in the spring of first grade. Table 3 displays the results of these regressions. (Coefficients and standard errors in this table result from appropriately averaging the estimates for each of the five data sets containing imputed values.) Regressions predicting the different dependent variables are shown in the columns of this table. The first five are the different behavior problem variables; the final column is for reading problems. The key independent variables are reading problems (the second row of the table) and different types of behavior problems (the third through seventh rows). The remaining rows of the table show the effects of the control variables.

Table 3's first column displays the results for approaches to learning (measured by the teacher's judgments of the student's attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and organization). This variable is the ECLS-K's best measure of learning-related or task-focused behaviors, and it is also the variable that, after controlling prior test performance, best predicts future test performance (Tach & Farkas, 2006). Here, we found strong support for the hypothesized model's causal relation. Statistically controlling for (a) poor task engagement in spring of first grade, (b) self-control problem behaviors (as a measure of attention-related problems), and (c) a wide range of SES- and demographic-related control variables, we found that being a poor reader elevated a child's odds by 2.17 ($p < .001$) of displaying poor task engagement in the spring of third grade.

Table 3's second column displays results of these analyses for self-control behavior problems. Once again, the analyses yielded preliminary evidence for the hypothesized causal relation. Controlling for a wide range of confounds, including both poor task engagement (as a control for attention-related problem behaviors) and poor self-control in spring of first grade, the odds that a poor reader displayed poor self-control in the spring of third grade were 1.33 times higher ($p < .05$) than the odds for an average-to-good reader. The effect was smaller than that for predicting the approaches-indexed behavior problems, but still statistically significant.

Table 3's next column presents the analysis for interpersonal behavior problems in spring of third grade. Here and subsequently, to retain comparability across these analyses, we included two first-grade behavior problems variables as controls—the variable used as the dependent variable (in this case, interpersonal behavior problems) and the approaches to learning variable (again, as a control for attention problems). In this case, our results do not support a hypothesized relation between reading and behavior problems; net of the control variables, the estimated effect does not achieve statistical significance. Hence, being a poor reader in first grade was not a risk factor for displaying poor interpersonal skills in the third grade.

Table 3's fourth column displays the analyses for externalizing behavior problems. Here, the odds ratio for the effect of reading problems in first grade was a statistically significant 1.39 ($p < .05$), supporting a relation between reading and externalizing behavior problems. A similar result is found in the fifth column for the prediction of internalizing behavior problems. Net of statistical controls, the odds that a child displayed internalizing problem behaviors in the spring of third grade were 1.66 times higher ($p < .001$) for poor readers than for average-to-good readers.

Overall, these regressions provide consistent evidence that being a poor reader in first grade increases a child's

*(text continues on page 430)*

## Table 3
## Multilevel Logistic Regression Analyses of Behavior and Reading Problems in Spring of Third Grade

| | T5 Approaches Problems | | | T5 Self-Control Problems | | | T5 Interpersonal Problems | | | T5 Externalizing Problems | | | T5 Internalizing Problems | | | T5 Reading Problems | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* |
| Intercept | –3.937 | 0.019 | *** | –3.128 | 0.044 | *** | –3.534 | 0.029 | *** | –3.851 | 0.021 | *** | –2.819 | 0.060 | *** | –5.424 | 0.004 | *** |
| | (0.211) | | | (0.155) | | | (0.197) | | | (0.176) | | | (0.154) | | | (0.229) | | |
| T4 reading problems | 0.774 | 2.168 | *** | 0.288 | 1.334 | * | 0.178 | 1.195 | | 0.331 | 1.392 | * | 0.508 | 1.662 | *** | 2.485 | 12.005 | *** |
| | (0.113) | | | (0.115) | | | (0.141) | | | (0.127) | | | (0.117) | | | (0.101) | | |
| T4 approaches problems | 1.201 | 3.322 | *** | 0.406 | 1.501 | * | 0.552 | 1.736 | *** | 0.304 | 1.356 | ** | 0.660 | 1.935 | *** | 1.123 | 3.074 | *** |
| | (0.100) | | | (0.162) | | | (0.110) | | | (0.115) | | | (0.115) | | | (0.125) | | |
| T4 self-control problems | 0.583 | 1.791 | *** | 1.337 | 3.809 | *** | | | | | | | | | | –0.102 | 0.903 | |
| | (0.135) | | | (0.154) | | | | | | | | | | | | (0.278) | | |
| T4 interpersonal problems | | | | | | | 1.203 | 3.332 | *** | | | | | | | –0.179 | 0.836 | |
| | | | | | | | (0.116) | | | | | | | | | (0.173) | | |
| T4 externalizing problems | | | | | | | | | | 1.873 | 6.509 | *** | | | | 0.066 | 1.069 | |
| | | | | | | | | | | (0.091) | | | | | | (0.159) | | |
| T4 internalizing problems | | | | | | | | | | | | | 0.930 | 2.534 | *** | 0.274 | 1.315 | |
| | | | | | | | | | | | | | (0.118) | | | (0.141) | | |
| More than 25% Black students | –0.352 | 0.703 | ** | –0.211 | 0.810 | | –0.381 | 0.683 | * | –0.189 | 0.828 | | 0.056 | 1.057 | | 0.015 | 1.015 | |
| | (0.132) | | | (0.138) | | | (0.153) | | | (0.146) | | | (0.132) | | | (0.131) | | |
| More than 25% Hispanic students | 0.012 | 1.012 | | –0.122 | 0.885 | | –0.019 | 0.982 | | 0.046 | 1.047 | | 0.061 | 1.063 | | 0.132 | 1.142 | |
| | (0.163) | | | (0.145) | | | (0.137) | | | (0.178) | | | (0.159) | | | (0.154) | | |
| % eligible for free lunch | 0.001 | 1.001 | | 0.003 | 1.003 | | 0.004 | 1.004 | | –0.001 | 0.999 | | 0.001 | 1.001 | | 0.008 | 1.008 | *** |
| | (0.002) | | | (0.002) | | | (0.002) | | | (0.002) | | | (0.002) | | | (0.002) | | |
| Gender (male) | 0.822 | 2.274 | *** | 0.490 | 1.633 | *** | 0.506 | 1.659 | *** | 0.614 | 1.848 | *** | 0.074 | 1.077 | | 0.282 | 1.325 | *** |
| | (0.080) | | | (0.073) | | | (0.076) | | | (0.085) | | | (0.073) | | | (0.086) | | |
| Age at K entry | –0.021 | 0.979 | * | –0.007 | 0.993 | | –0.014 | 0.986 | | –0.017 | 0.983 | | 0.001 | 1.001 | | –0.012 | 0.988 | |
| | (0.010) | | | (0.010) | | | (0.013) | | | (0.011) | | | (0.010) | | | (0.010) | | |
| Mother's education | | | | | | | | | | | | | | | | | | |
| Less than high school | 0.462 | 1.588 | * | 0.204 | 1.226 | | 0.317 | 1.372 | | 0.186 | 1.204 | | 0.196 | 1.216 | | 0.898 | 2.455 | *** |
| | (0.184) | | | (0.150) | | | (0.198) | | | (0.172) | | | (0.210) | | | (0.227) | | |
| High school diploma | 0.453 | 1.573 | ** | 0.120 | 1.128 | | 0.146 | 1.157 | | 0.128 | 1.137 | | 0.159 | 1.172 | | 0.651 | 1.918 | ** |
| | (0.148) | | | (0.119) | | | (0.128) | | | (0.137) | | | (0.140) | | | (0.199) | | |
| Some college | 0.349 | 1.418 | ** | 0.191 | 1.210 | | 0.133 | 1.142 | | 0.210 | 1.234 | | 0.115 | 1.122 | | 0.587 | 1.798 | ** |
| | (0.127) | | | (0.114) | | | (0.130) | | | (0.122) | | | (0.139) | | | (0.186) | | |
| Father's education | | | | | | | | | | | | | | | | | | |
| Less than high school | 0.269 | 1.309 | | 0.014 | 1.014 | | –0.046 | 0.955 | | 0.248 | 1.282 | | 0.034 | 1.035 | | 0.634 | 1.886 | ** |
| | (0.178) | | | (0.148) | | | (0.210) | | | (0.218) | | | (0.199) | | | (0.220) | | |
| High school diploma | 0.202 | 1.224 | | –0.021 | 0.979 | | 0.091 | 1.095 | | 0.093 | 1.097 | | 0.063 | 1.065 | | 0.460 | 1.584 | * |
| | (0.151) | | | (0.120) | | | (0.151) | | | (0.150) | | | (0.144) | | | (0.208) | | |
| Some college | 0.123 | 1.131 | | 0.035 | 1.036 | | 0.101 | 1.106 | | 0.109 | 1.115 | | 0.089 | 1.093 | | 0.362 | 1.436 | |
| | (0.135) | | | (0.113) | | | (0.129) | | | (0.127) | | | (0.117) | | | (0.191) | | |

*(continued)*

**Table 3 (continued)**

| | T5 Approaches Problems | | | T5 Self-Control Problems | | | T5 Interpersonal Problems | | | T5 Externalizing Problems | | | T5 Internalizing Problems | | | T5 Reading Problems | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* |
| Family below poverty level | –0.008 | 0.992 | | 0.033 | 1.033 | | 0.139 | 1.149 | | 0.032 | 1.033 | | 0.179 | 1.196 | | 0.283 | 1.327 | * |
| | (0.126) | | | (0.112) | | | (0.114) | | | (0.138) | | | (0.146) | | | (0.120) | | |
| Federal programs | | | | | | | | | | | | | | | | | | |
| Family received AFDC | 0.209 | 1.233 | | 0.210 | 1.234 | | 0.108 | 1.114 | | 0.080 | 1.083 | | –0.061 | 0.941 | | 0.248 | 1.282 | |
| | (0.214) | | | (0.147) | | | (0.249) | | | (0.213) | | | (0.228) | | | (0.164) | | |
| Family received food stamps | 0.180 | 1.197 | | 0.123 | 1.131 | | 0.217 | 1.242 | | 0.041 | 1.041 | | 0.146 | 1.157 | | 0.197 | 1.218 | |
| | (0.131) | | | (0.124) | | | (0.131) | | | (0.170) | | | (0.133) | | | (0.140) | | |
| WIC during pregnancy and childhood | 0.216 | 1.241 | | 0.224 | 1.250 | * | 0.344 | 1.411 | ** | 0.207 | 1.230 | | 0.285 | 1.330 | ** | 0.336 | 1.399 | ** |
| | (0.109) | | | (0.095) | | | (0.110) | | | (0.112) | | | (0.104) | | | (0.119) | | |
| WIC during pregnancy or childhood | 0.098 | 1.103 | | 0.222 | 1.248 | | 0.253 | 1.288 | | 0.187 | 1.206 | | 0.187 | 1.206 | | 0.172 | 1.188 | |
| | (0.150) | | | (0.143) | | | (0.155) | | | (0.167) | | | (0.160) | | | (0.183) | | |
| Head Start participation | 0.109 | 1.115 | | 0.020 | 1.020 | | –0.175 | 0.839 | | 0.013 | 1.013 | | 0.033 | 1.034 | | –0.011 | 0.989 | |
| | (0.108) | | | (0.098) | | | (0.119) | | | (0.116) | | | (0.116) | | | (0.116) | | |
| Race | | | | | | | | | | | | | | | | | | |
| Black non-Hispanic | 0.381 | 1.464 | ** | 0.560 | 1.751 | *** | 0.560 | 1.751 | *** | 0.819 | 2.267 | *** | –0.149 | 0.862 | | 0.489 | 1.630 | *** |
| | (0.137) | | | (0.132) | | | (0.150) | | | (0.121) | | | (0.136) | | | (0.135) | | |
| Hispanic | –0.202 | 0.817 | | –0.103 | 0.902 | | 0.010 | 1.010 | | –0.059 | 0.943 | | –0.144 | 0.866 | | 0.279 | 1.322 | |
| | (0.164) | | | (0.124) | | | (0.140) | | | (0.159) | | | (0.145) | | | (0.146) | | |
| Asian | –0.771 | 0.463 | * | –0.371 | 0.690 | | –0.463 | 0.630 | | –0.604 | 0.546 | * | –0.720 | 0.487 | * | –0.447 | 0.639 | |
| | (0.335) | | | (0.202) | | | (0.259) | | | (0.272) | | | (0.309) | | | (0.260) | | |
| Other | –0.128 | 0.880 | | –0.046 | 0.955 | | 0.188 | 1.206 | | 0.000 | 1.000 | | 0.028 | 1.029 | | 0.327 | 1.386 | |
| | (0.167) | | | (0.152) | | | (0.205) | | | (0.191) | | | (0.185) | | | (0.177) | | |
| Household structure | | | | | | | | | | | | | | | | | | |
| Single-parent family | 0.317 | 1.373 | * | 0.245 | 1.277 | ** | 0.255 | 1.290 | * | 0.329 | 1.390 | * | 0.270 | 1.310 | * | 0.037 | 1.038 | |
| | (0.118) | | | (0.092) | | | (0.110) | | | (0.126) | | | (0.112) | | | (0.133) | | |
| Other structures | 0.465 | 1.593 | ** | 0.463 | 1.589 | *** | 0.443 | 1.558 | *** | 0.521 | 1.684 | *** | 0.361 | 1.435 | * | –0.051 | 0.951 | |
| | (0.142) | | | (0.105) | | | (0.116) | | | (0.117) | | | (0.146) | | | (0.123) | | |

*(continued)*

## Table 3 (continued)

| | T5 Approaches Problems | | | T5 Self-Control Problems | | | T5 Interpersonal Problems | | | T5 Externalizing Problems | | | T5 Internalizing Problems | | | T5 Reading Problems | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* | Log Odds | Odds Ratio | *p* |
| Number of siblings | –0.021 | 0.979 | | –0.067 | 0.935 | * | –0.091 | 0.913 | * | –0.040 | 0.961 | | –0.053 | 0.949 | | 0.136 | 1.145 | *** |
| | (0.037) | | | (0.031) | | | (0.042) | | | (0.042) | | | (0.031) | | | (0.035) | | |
| Home language not English | –0.115 | 0.891 | | –0.111 | 0.895 | | –0.190 | 0.827 | | –0.215 | 0.806 | | –0.102 | 0.903 | | 0.377 | 1.458 | * |
| | (0.168) | | | (0.151) | | | (0.223) | | | (0.185) | | | (0.184) | | | (0.152) | | |
| Mother's age at first birth | 0.174 | 1.190 | | 0.171 | 1.187 | * | 0.068 | 1.070 | | 0.204 | 1.227 | | –0.052 | 0.950 | | 0.191 | 1.210 | * |
| | (0.089) | | | (0.085) | | | (0.104) | | | (0.127) | | | (0.115) | | | (0.095) | | |
| Region | | | | | | | | | | | | | | | | | | |
| Midwest | –0.003 | 0.997 | | 0.165 | 1.179 | | 0.209 | 1.232 | | 0.173 | 1.189 | | –0.109 | 0.897 | | –0.171 | 0.843 | |
| | (0.148) | | | (0.123) | | | (0.148) | | | (0.128) | | | (0.140) | | | (0.140) | | |
| South | –0.022 | 0.978 | | 0.003 | 1.003 | | –0.033 | 0.968 | | 0.029 | 1.030 | | –0.177 | 0.838 | | –0.056 | 0.945 | |
| | (0.128) | | | (0.120) | | | (0.147) | | | (0.134) | | | (0.128) | | | (0.131) | | |
| West | 0.074 | 1.077 | | 0.038 | 1.038 | | –0.004 | 0.996 | | 0.203 | 1.225 | | 0.010 | 1.010 | | 0.033 | 1.033 | |
| | (0.127) | | | (0.148) | | | (0.140) | | | (0.163) | | | (0.136) | | | (0.149) | | |
| Urbanicity | | | | | | | | | | | | | | | | | | |
| Large and mid-size cities | –0.004 | 0.996 | | –0.084 | 0.919 | | –0.064 | 0.938 | | 0.020 | 1.020 | | –0.053 | 0.949 | | 0.058 | 1.059 | |
| | (0.095) | | | (0.095) | | | (0.109) | | | (0.100) | | | (0.116) | | | (0.111) | | |
| Small town and rural | –0.094 | 0.910 | | 0.016 | 1.016 | | 0.003 | 1.003 | | 0.124 | 1.133 | | –0.085 | 0.919 | | 0.343 | 1.409 | ** |
| | (0.110) | | | (0.100) | | | (0.115) | | | (0.109) | | | (0.116) | | | (0.118) | | |
| Level 2 variance | | 0.242 | * | | 0.296 | | | 0.322 | | | 0.202 | *** | | 0.282 | ** | | 0.293 | |

Note: Level 1 $n$ = 11,515. Level 2 $n$ = 1,471. Standard errors are in parentheses. Random intercept, Bernoulli. T4 = spring of first grade; T5 = spring of third grade; AFDC = Aid to Families with Dependent Children; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.
*$p$ < .05. **$p$ < .01. ***$p$ < .001.

likelihood of displaying behavior problems in third grade. Statistically significant effects are found for the prediction of four of five types of behavior problems. The largest effect is for problems in approaches to learning, a measure of task-focused and learning-related behaviors.

### Are Behavior Problems a Risk Factor for Reading Problems?

Table 3's sixth column displays the results of regressions predicting reading problems in the spring of third grade. The independent variables of interest for these regressions were the dummy variables for problem behaviors in the spring of first grade. Despite the autoregressor's strength (an extraordinarily high odds ratio of 12.01; $p < .001$), one type of behavior problem remained a statistically significant predictor. The odds of being a poor reader in the spring of third grade were 3.07 ($p < .001$) higher if a child was displaying low levels of task-focused behaviors in the spring of first grade. Again, this was the strength of association after statistically controlling for both the autoregressor and a wide range of SES- and demographic-related variables. It is clear that task-related behavior problems in first grade strongly predicted reading problems in third grade.

## Discussion

We first tested whether being a poor reader by the spring of first grade increased the likelihood that a child would engage in problem behaviors by the spring of third grade. We estimated the predictive strength of this relation after controlling for prior problem behavior, attention, and other potential confounds (e.g., parent education, family structure, poverty, gender, and race). By taking into account a large set of potential confounds using a nationally representative data set, we attempted to better isolate the hypothesized strength of the relation between reading and behavior problems. We were especially interested in whether the strength of relation varied by behavior problem type.

We found that reading problems indeed elevated a child's odds of engaging in problem behaviors. Specifically, we found that, after statistically controlling for prior problem behavior, poor attention, and both SES- and demographic-related confounds, poor reading ability in first grade consistently acted as a statistically and clinically significant predictor of problem behavior in third grade. The odds of displaying poor task engagement, poor self-control, externalizing problem behaviors, or internalizing problem behaviors in third grade were 2.17, 1.33, 1.39, and 1.66 times higher, respectively, for poor readers than for average-to-good readers. Collectively, these odds ratios indicate a modest-to-moderate relation between reading problems and certain types of problem behaviors (Haddock, Rindskopf, & Shadish, 1998). Whereas the predictive strength of poor reading varied by behavior type, it almost always remained a highly statistically (despite the substantial number of confounds entered into the analyses) and practically (given the negative outcomes associated with displaying problem behaviors) significant predictor. The only exception to this pattern was the relation with interpersonal problem behavior. In this case, although the odds ratio was above 1, it failed to achieve statistical significance.

We then tested whether displaying abnormal levels of one of five types of behavior in first grade increased the likelihood that a child would be a poor reader in third grade. We estimated the predictive strength of this relation after controlling for prior reading problems and both SES- and demographic-related confounds. Here, we found that abnormal levels of only one of the five types of behavior (i.e., poor task engagement) elevated a child's odds of being a poor reader in third grade. This odds ratio was a high 3.07. We also found that poor readers in first grade were almost always poor readers in third grade. These odds were an extraordinary high 12.01 to 1.

Taken together, these two sets of analyses provide preliminary support for a bidirectional causal model between reading and behavior problems. Our analyses support four pathways of risk: (a) Early reading problems strongly predict later reading problems; (b) early behavior problems strongly predict later behavior problems; (c) early reading problems modestly-to-moderately predict a general set of behavior problems; and (d) one type of early behavior problem (i.e., the type most directly related to self-regulation of learning) strongly predicts later reading problems. We believe it to be unlikely that these relations are spurious because of the large number of confounds controlled for in the analyses.

### Contributions to the Extant Literature

Our findings extend work from previous investigations. To date, few experimental studies in this research area have been conducted. Moreover, methodological limitations have typified much of the causal modeling work on the link between reading and behavior problems (Hinshaw, 1992; Spira & Fischel, 2005). Specifically, few of the modeling studies have (a) controlled for prior problem behavior as a predictor, (b) included common cause variables such as attention problems or socioeconomic

background, (c) used longitudinal data sets, or (d) tested alternative causal models. In contrast, our study's analyses statistically controlled for prior problem behavior, prior reading problems, attention problems, and many demographic- and SES-related variables while also testing a cross-lagged model of over-time effects. These analyses were based on a large data set. If the hypothesized bidirectional model is indeed "true" (i.e., accurately specified and estimated without undue measurement error; Shadish et al., 2002), then our findings should accurately describe the nature and strength of the interrelations between reading and behavior problems in the primary grades. However, systematic randomized experiments are needed to confirm that this bidirectional model can indeed be characterized as causal.

Our results also seem to support elements of Stanovich's (1986) Matthew effects model. We found that, as predicted, early reading failure negatively affected children's later behavior. The effect seemed to generalize. That is, not only were poor readers in first grade more likely to be task avoidant in third grade, they were also more likely to act out, withdraw from classroom activities, and display poor self-control. That the effect was strongest for task engagement is consistent with the Matthew effects model in that this behavior is the one most closely related to the classroom's learning demands. Only the behavior that was, arguably, least related to these demands (i.e., interpersonal skills, or the ability to make and keep friends) was relatively resistant to early but severe reading difficulties.

Our results offer mixed support for the hypothesis that poor reading ability results from a young child's behavior problems. Neither poor self-control nor poor interpersonal skills nor externalizing problem behaviors nor internalizing problem behaviors in first grade predicted reading problems in third grade. Instead, we found that only poor task engagement in first grade strongly predicted poor reading in third grade. Thus, it seems that only those behaviors that might be considered proximally related to deficits in executive functioning acted as a risk factor for reading failure. This finding is consistent with McDermott et al.'s (2006) results, in which frequently engaging in learning-related behaviors acted to decrease children's risk for each of the measured types of LD (i.e., reading, spelling, and mathematics disabilities). In contrast, aggression, defiance, and other types of problem behaviors had inconsistent effects on children's risk for LD identification.

Our results, therefore, might be characterized as consistent with a *restricted* executive function model, in which poor self-regulation of behavior constrains the child's ability to meet the classroom's learning demands. However, a *full* model, in which this second set of problem behaviors also undermined children's reading growth, was not supported. Indirect evidence for this distinction is reported in two other recent studies. Johnson et al. (2005) found that most of the association between children's disruptive behavior and school grades could be accounted for by poor attention and ability. Clark, Prior, and Kinsella (2002) found that children with both attention and externalizing behavior problems scored lower on a reading test than typical peers, but not those displaying only externalizing behavior problems.

## The Study's Limitations

Several limitations characterize this study. First, our analyses are based on a limited number of time points (see Raudenbush, 2001) as well as on a sample of children who did not change schools between these time points. Second, our analyses are based in part on multiply imputed values replacing varying amounts of missing data. Third, we did not manipulate a hypothesized causal agent (e.g., pronounced difficulty learning to read), which is the "gold standard" in demonstrating a causal relation (e.g., Shadish et al., 2002; Tabachnick & Fidel, 1989). Instead, we attempted to test the degree to which reading and behavior problems interrelated in a hypothesized bidirectional causal model. Because we did so after taking into account a large set of potential confounds, we characterize our results as providing relatively accurate estimates of these interrelations in the hypothesized model (i.e., that poor reading causes poor behavior and that poor behavior causes poor reading). There is a persuasive methodological rationale for considering these estimates as accurate (e.g., Aneshensel, 2002; Kenny, 1979) if the model is indeed accurately specified. It is also important to note that our study's odds ratios estimate a child's risk of experiencing the negative outcome and, thus, are inherently probabilistic rather than deterministic (D. Little, 1991). As with any type of causal modeling analysis, it is also possible that we did not include an important confound into the analyses (whether hitherto identified or not) that could explain the effects we attribute to reading or behavior problems.

## Implications for Further Research and Practice

Our study has both theoretical and practical implications. Theoretically, the findings highlight the need for continued investigations into the links between academic performance problems and behavior problems. A diverse set of questions remains to be explored. For example, why are reading problems more likely to lead to internalizing problem behaviors than to interpersonal problem

behaviors? Are the negative effects on behavior unique to whether a child does poorly in reading, or does poor performance in other academic subjects (e.g., math) also lead to behavior problems? How do these relationships evolve as children move to higher grade levels?

Practically, our findings suggest the need for a multifaceted approach toward preventing the later occurrence of either reading or behavior problems. It is interesting that this agrees with findings from at least two intervention studies, which indicate that resistance to intervention is associated with executive functioning-related behaviors such as inattention and poor inhibitory control (Riggs et al., 2006; Torgesen et al., 1999). Here, children appeared more likely to become poor readers in third grade if they left first grade as poor readers *or* as task-avoidant learners. Children also appeared more likely to become task-avoidant learners in the third grade if they left first grade as task-avoidant *or* as poor readers. Collectively, then, others' and our findings (e.g., Rabiner, Malone, & the Conduct Problems Prevention Research Group, 2004; Spira et al., 2005) point to the need to ensure that children in the primary grades move on to subsequent grades with the requisite reading skills and self-regulatory, task-focused behaviors. The most effective types of interventions are likely to be those that target both reading and behavior problems simultaneously.

## Note

1. The *Early Childhood Longitudinal Study–Kindergarten Class* (ECLS-K) includes 13,964 children who were interviewed during the spring of first and third grades. Of these, 2,449 children (17.54%) changed schools some time between the two time periods. Those children who did and who did not change schools displayed different sociodemographic characteristics. For example, and compared with children who did not change schools, children who changed schools were more likely to (a) come from poor, less educated, and single-parent families and (b) attend schools where a higher percentage of children lived in poverty. Children who changed schools also displayed somewhat higher means on all of our study's dependent variables, suggesting that these children were more likely to display reading and behavior problems. However, although most of the aforementioned mean or percentage differences were statistically significant (due in part to the relatively large number of children in each sample), the magnitudes of these differences were not typically substantial. For instance, the differences between those who changed and those who did not change schools on our study's dependent variables ranged between 1.93 and 4.22 percentage points.

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